

but is, in each case, a partly detached layer of snow, that adhered to and was partly lifted up by the roll while that was revolving, but that settled back to earth at a later time, owing to the continuation of the process of partial melting that was going on at a temperature of  $34^{\circ}$  to  $36^{\circ}$  F. In case the roller had undergone another revolution such windward layer would doubtless have gone with it, and been incorporated within the mass. Many of the rollers formed on a practically level surface, and some were actually rolled up a slight incline.

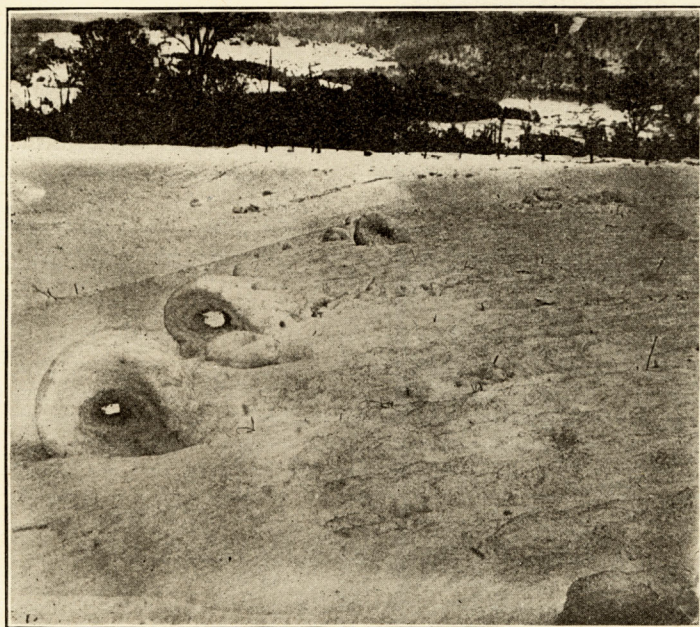


FIG. 1.—Snow rollers at Jericho, Vt.



FIG. 2.—Snow rollers at Jericho. Vt.

#### SNOW ROLLERS AT MOUNT PLEASANT, MICH.

By Prof. R. D. CALKINS. Dated Central State Normal School, Mount Pleasant, Mich., June 27, 1906.

On the evening of January 17 [1906], the wind at Mount Pleasant, Mich., was northeast, and a light flaky snow was falling. During the night the wind backed through north and

northwest to the southwest. In the morning we found that at the northwest corner of the Normal School Building snowballs, or snow rolls, to the number of fifty or seventy-five had been formed. They varied in size from three inches in diameter to twelve inches. They were rolls of snow rather than snowballs, for most of them had square ends. They were spiral in structure when viewed from the end. Behind each roll was a path where the snow had been taken up, and the depth of snow removed from this path corresponded very closely to the thickness of the layers forming the roll. These paths became narrower as the corner of the building was approached, where they all disappeared, as indicated in the diagram, fig. 1. The rolls were very light and would hardly hold together sufficiently to preserve their shape when lifted. Some boys from the country on the same morning reported similar balls two feet in diameter. The wind has a long, unobstructed sweep from the southwest. There were no tracks of children about the balls, and there can be no doubt that they were wind-formed. Can you give me any more information concerning the origin of such balls or rolls? Just why, and how, do they start?

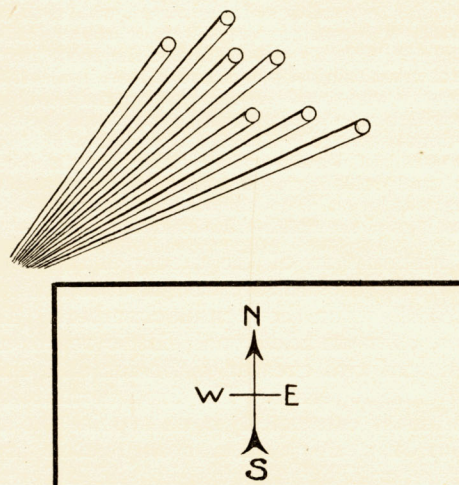


FIG. 1.—Paths of snow rollers at Mount Pleasant, Mich.

*Note.*—The initial step in the formation of snow rolls seems not yet to have been observed. They appear generally to be formed at nighttime, or in the very early morning, and the diagram by Professor Calkins suggests that they are formed by or among the eddies in the strong wind at the corner of a building or other obstacle.

We note that in the *Meteorologische Zeitschrift*, May, 1895, p. 198, Prof. K. R. Koch, of Stuttgart, mentions three ways in which snow becomes hardened after it has fallen:

1. A warm snowfall is followed by cold west winds that favor compression, the wind in descending gusts forcing or pressing it into a hard, solid mass.

2. Hard surfaces are formed by melting and freezing and become hard enough to support the mountain climbers in the Alps and Black Forest.

3. In March and April in the mountains, before thawing weather begins, the insolation is powerful, and snow crystals exposed in the sunshine are evaporated and the vapor is actually recrystallized; thus very large crystals are formed and the layers of snow become quite solid; it is not impossible that large nuclei may thus be formed.—C. A.

#### MONTHLY REVIEW OF THE PROGRESS OF CLIMATOLOGY THROUGHOUT THE WORLD.

By C. FITZHUGH TALMAN, U. S. Weather Bureau.

#### THE ASIATIC RAILROADS AND THE PROGRESS OF METEOROLOGY.

This is emphatically an era of railroad building throughout Asia. It may be but a few years before we witness in Asia a



sort of parallel to the most impressive geographical event of last year, which I take to have been the journey of the members of the British Association, by rail, from Capetown to the Zambesi. One of these days the same body will assemble in the Indian Empire, journey over the railroads now existing to Darjiling, and there board a specially chartered train of the "Trans-Tibetan" or the "Asia Central" for some point or other in the Chinese Delta.

Then, perhaps, we shall have, from the entertaining pen of Dr. Hugh Robert Mill, "Central Asia as seen by a meteorologist", illustrated with photographs of the meteorological observatories of Lassa (central office of the Pontifical Tibetan Weather Service) and Singan-fu.<sup>1</sup>

While statesmen are concerned with the political advantages to be derived from the new iron highways into the Asiatic interior, and while the commercial world is counting the material gains sure to accrue from the opening of new countries to trade, the meteorologist may be pardoned for indulging in a little jubilation on his own account, as he beholds the region over which the phenomena of the atmospheric circulation assume grander proportions than anywhere else upon the globe brought more and more fully within the field of his observation. The time can not be far distant, unless wholly improbable circumstances should check the present tide of progress in the eastern world, when the scant and hasty meteorological gleanings of the geographical explorer will give place to data regularly supplied by well equipped observatories and flashed over the earth by wire (or wireless) for the benefit of the weather forecaster.

It is significant of the importance which forecasters, no less than climatologists, attach to the meteorology of Asia, as a preponderating factor in the meteorology of the Northern Hemisphere, that the Indian Meteorological Department has recently arranged to receive daily telegraphic reports from six Russian stations in Siberia, and that the United States Weather Bureau is even now negotiating with the Russian service for reports from the same region. The stations from which these reports will come lie to the north and west of the mean position of the great central Asian winter "high"—the area of greatest pressure observed upon the earth—whether we accept its location as shown on Buchan's charts, the more southerly position in the Russian Climatological Atlas, or the extreme westerly position<sup>2</sup> indicated by certain recent investigations.

While the indications of these outlying stations may suffice to give us a general notion of the pressure fluctuations from day to day, the absolute value of the pressure in this all-important anticyclone must remain a matter of considerable uncertainty until new stations are established, at known elevations, in the very heart of Asia. With the development of railroads in this region, the establishment of the desired stations will be a matter of easy accomplishment. Besides making the region easy of access to European observers, the building of railroads will entail leveling operations supplying the precise altitude data required for the reduction of the pressure to sea level.

Of the many railroad projects now on foot in Asia the one that appears to promise most for meteorology contemplates the building of a line up the Irtysh Valley from some point on the Trans-Siberian Railway to the Chinese town of Chuguchak, within the borders of Sungaria. This is the route by which the Russians are now planning to open Mongolia to their commerce, in lieu of the road which they proposed building

over the old caravan route from Irkutsk to Peking, via Urga, and which was abandoned because of the political results of the Russo-Japanese war. Of but little less importance is the proposed railway across the Kirghiz steppe to Tashkent.

Many circumstances denote the beginning of a new and hopeful era in the meteorological exploration of Asia, but space permits us to mention only two—the abandonment by the Tibetans of the policy which excluded foreigners from their territory (the happy result of the British Mission of 1904), and the recent awakening of China to the advantages of western institutions, especially railroads and telegraphs; of the latter, China now has some 15,000 miles in operation.

The Anglo-Chinese treaty regarding Tibet, signed April 23, 1906, opens certain trade marts in Tibet to the commerce of India, authorizes the Indian government to connect these places with India by telegraph, and grants to the British preference in the matter of railway concessions.

#### DOCTOR KOSTLIVY ON THE CLIMATE OF BEIRUT.

Regierungsrat Stanislav Kostlivy, the veteran vice-director of the Austrian Centralanstalt für Meteorologie, who died October 7, 1905, left behind him, in the press, an elaborate and beautiful discussion of the meteorological observations at the Syrian Protestant College, Beirut, for the twenty-five years, 1876-1900.<sup>3</sup> This monograph is an excellent example of the painstaking methods of the Austrian climatologists, and is commended to the attention of anyone who contemplates writing an extensive discussion of the climate of a single station or small region. Beirut is one of the very few places in the Turkish Empire having a long unbroken meteorological record. The observations at the Syrian Protestant College, which is a purely American institution, have been published *in extenso* in the Jahrbücher of the K. k. Centralanstalt für Meteorologie, Vienna, since 1876.

Among the interesting facts brought out in the present discussion we notice that snow has never fallen in Beirut, though it sometimes falls on the nearby Lebanon and is not of very uncommon occurrence at Jerusalem, 150 miles farther south.

#### AUSTRALIAN HEAT VERSUS WHITE LABOR.

In the course of his Lake Eyre expedition of 1901-2, Dr. J. W. Gregory, of the University of Glasgow, was much impressed with the immunity with which white men pursue the most laborious occupations under the blazing sun of the Australian "back of beyond". His picture of the conditions of white labor in this part of the world is a genuine contribution to "anthropoclimatology":<sup>4</sup>

At Jibuti, in eastern tropical Africa, ten minutes' midday exposure without a hat is said to be inevitably fatal. But in Central Australia even newcomers like ourselves could go about hatless for longer periods without feeling any ill effects. We expected to find everyone hating the heat and devoting their utmost ingenuity to combat it. As the "terai" hats of tropical Africa and India are made of two layers, we expected to find at least a three-storied variety in use around Lake Eyre. Green umbrellas we thought would be man's constant companions, and after Sturt's experiences we should not have been surprised to find advertisements of inks guaranteed to remain liquid through a Central Australian summer, and pencils of plutonic graphite recommended for use in the Lake Eyre basin. (I have been seriously assured that Sturt could not keep a diary through the hot weather, as the heat softened the lead in his pencils.) But, on the contrary, the residents adopt no special precautions against heat. Our efforts to buy a sun umbrella were in vain; one storekeeper assured me that they were rarely used north of Adelaide. Houses are built of corrugated iron and not one in a dozen condescends to a veranda. \* \* \*

But in spite of the heat the people looked extremely well. The children were harder and less anemic than those at Adelaide. Doctor Kennedy assured me that there is no illness in the district, and that his post would be a sinecure were it not for ophthalmia and other ailments of the eyes. To my surprise we found men working in the open air at severe manual labor without adopting any precautions or special clothes. Simple slouch felt, or thin straw hats are generally worn, and our cook

<sup>1</sup> Cf. Doctor Mill's delightful chat, "South Africa as seen by a meteorologist", in Quarterly Journal of the Royal Meteorological Society, July, 1906.

<sup>2</sup> With a center near Turfan, longitude 89° east, latitude 43° north, in Chinese Turkestan. See Comptes Rendus Acad. des Sciences, Paris, t. CXXVIII, No. 3 (January 16, 1899), p. 154.

<sup>3</sup> Kostlivy, Stanislav. Untersuchungen über die klimatischen Verhältnisse von Beirut, Syrien. Prag, 1905.

<sup>4</sup> Gregory, J. W. The dead heart of Australia; a journey around Lake Eyre in the summer of 1901-2... London, 1906.